ARRANGEMENT USED TO FIX CONDUCTOR RAILS FOR MULTI-PHASE SWITCHGEARS

[0001] The present invention relates to an arrangement for securing contact straps for multiphase switching devices, in particular for contactors, as set forth in the preamble of Claim 1.

[0002] Contact straps in multiphase electrical switching devices have a connecting terminal at their outer end and are directly or indirectly connected to a stationary contact member with their inner end, said stationary contact member being brought into and out of contact with a movable contact member. It is known for contact straps to be secured in the switching device housing by pressing them in or embedding them by an injection molding process (DE 19904355 A1), by adhesive bonding (DE 10036350 A1), by a screw connection with a female thread in the switching device housing (DE 29604726 U1), in threaded plates (DE 19814410 A1), or in the contact straps (DE 3232173 C2), by holding them down with housing parts intended for this purpose (EP 645792 A1), by insertion (DE 10061394 A1) or by riveting.

[0003] The disadvantages of the known arrangements for securing contact straps are the high technological requirements in terms of equipment, tools and work hours for implementing the attachment, as well as the removal of the contact straps, which is sometimes impossible, sometimes possible only under certain conditions, and sometimes requires considerable effort. For example, in the case of a three-phase contactor having screwed contact straps, a customer who wants to do the manufacturer-recommended replacement of worn contacts with new contacts by himself/herself must unscrew and re-attach at least six screws along with their six retaining elements. Adhesive bonding of the contact straps requires pretreatment of the surfaces as well as curing times. Adhesively bonded parts entail an increased recycling effort.

[0004] It is therefore the object of the present invention to allow easy mounting and removal of the contact straps.

[0005] Starting from an arrangement of the type mentioned at the outset, this objective is achieved according to the present invention by the features of the independent claim while advantageous refinements of the invention will be apparent from the dependent claims.

[0006] The straight guide elements and the receiving holes in the switching device housing, the through-holes in the contact straps and the one insertion comb per terminal side provide an arrangement for securing contact straps which enables the contact straps to be firmly secured in position with a few translational assembly movements. Thus, the process of securing the contact straps can be easily automated. In the arrangement of the present invention, there is no need for a female thread in the contact straps or in the switching device housing, or for threaded plates, and the retaining elements needed for screw connections are dispensed with. Because there are no iron parts, the conduction of current through the contact straps is not magnetically influenced in a negative way. Both the final attachment and the removal of all contact straps of a terminal side is carried out with a single movement of the hand by insertion and withdrawal of the insertion comb into and from the through-holes and receiving holes. When the housing cover of the switching device is removed, only two manual operations are required per terminal side for toolless mounting and removal of the contact straps, said manual operations being simple and quick to perform. The insertion comb is much easier to manipulate compared to smaller screws and retaining elements. To facilitate recycling, the insertion comb can be injection-molded from recoverable material. The insertion comb used, which is made of molded insulating material, facilitates compliance with clearance and creepage distance requirements to a significant degree. This problem is increasing in importance due to the trend toward switching devices of smaller and smaller size. The surface of the connecting web of the insertion comb can be used in a practical way for attaching instructions for the customer.

[0007] Advantageously, the insertion combs are clamped with their insertion pins in the through-holes and/or are held down by a housing cover of the switching device.

[0008] A practical insertion comb design is a cylindrical or prismatic configuration of the insertion pins, through-holes and receiving holes, for example, featuring a circular or polygonal cross-section. In one advantageous embodiment, the insertion pins are slotted lengthwise to

produce the frictional and/or form-locking connection between the through-holes and the receiving holes. Bevels on the free ends of the insertion pins facilitate insertion into the through-holes and receiving holes.

[0009] In an advantageous embodiment of the insertion comb, the connecting web is provided with compensating slots for improved compensation of tolerances in the distances between the receiving holes. For better handling, it is advantageous for the connecting web to be shaped like a handle.

[0010] To prevent the contact straps inserted in the guide elements from falling out before the insertion comb is inserted, the contact straps are provided with knobs which bring the contact straps into clamping contact with the guide elements as they are inserted into said guide elements.

[0011] In an advantageous refinement of the arrangement, the phase barriers of the switching device housing, i.e., the partitions separating the phases, are provided with receiving slots, which support the inserted insertion comb via its connecting web in a direction parallel to the direction of the terminals, thus contributing to an increase in the permissible tensile and compressive forces on the connecting terminals. To this end, the connecting web provided with compensating slots and the phase barriers provided with the receiving slots are advantageously meshed with each other crosswise.

[0012] Further details and advantages of the present invention will become apparent from the exemplary embodiment described below with reference to the Figures, in which:

[0013] Figure 1 is a view of an embodiment the securing arrangement according to the present invention, showing essential details of the invention in a switching device shown in a longitudinal cross-section;

[0014] Figure 2 is an exploded perspective view of the arrangement according to the present invention;

[0015] Figure 3 shows the inventive arrangement in an assembled perspective view.

[0016] The drawing shows the arrangement for securing contact straps, including the parts of a multi-pole switching device 2 in the form of a three-pole contactor that are essential to illustrate the invention. Switching device 2 is surrounded by a switching device housing 4, of which only the upper housing part is depicted in the drawing. Switching device housing 4 is closed at the front by a removable housing cover 6, as shown in Figure 1. For each current phase, one incoming and one outgoing contact strap 8 is secured in switching device housing 4. Each contact strap 8 is provided at its outer end with a connecting terminal 12 extending into the respective terminal compartment 10, and has a stationary contact member 14 at its inner end. The contact straps 8 belonging to a phase are electrically connected and disconnected by a contact bridge in a usual manner; stationary contact members 14 being brought into and out of contact with movable contact members attached to the contact bridge.

[0017] In switching device housing 4, groove-shaped guide elements 16 are formed in pairs opposite each other on each terminal side for each current phase, as shown in Figure 2. Plate-like central portion 18 of contact straps 8 is inserted between guide elements 16 until it abuts an end face 20 of guide elements 16 when contact strap 8 is in the installed position, which is shown in Figures 1 and 3. Each contact strap 8 is provided with a through-hole 22 which, in the installed position, coincides with a receiving hole 24 formed in switching device housing 4. Contact straps 8 have knobs 25 formed at the edges of the central portion 18, said knobs producing a clamping effect when contact straps 8 are inserted into guide elements 16. This clamping effect is sufficient to prevent contact straps 8 from sliding out of guide elements 16 when transported during the production of switching device 2.

[0018] The securing arrangement further includes an insertion comb 26 made of molded insulating material for each terminal side. Insertion comb 26 has one circular cylindrical insertion pin 28 for each current phase. The insertion pins 28 belonging to a terminal side are interconnected by a plate-like connecting web 30. Insertion pins 28 extend in one direction from

connecting web 30. Connecting web 30 is provided a handle 32, which is located opposite the insertion pins 28 projecting therefrom.

[0019] To secure contact straps 8 in their installed position, insertion combs 26 are inserted with their insertion pins 28 through through-holes 22 of contact straps 8 and into receiving holes 24 of switching device housing 4 such that they are clamped therein. To facilitate insertion, insertion pins 28 are provided with entry bevels 34 at their free ends. To be able to effectively compensate for tolerances in the geometric spacing of receiving holes 24 and insertion pins 28, connecting web 30 is provided with compensating slots 36 between insertion pins 28, said compensating slots being downwardly open as shown in the drawing. In the installed position, insertion combs 26 are additionally held down by the installed housing cover 6.

[0020] Switching device housing 4 has continuous inner phase barriers 38 extending lengthwise. As shown in the drawings, upwardly open receiving slots 40 are formed in phase barriers 38 on each terminal side, said receiving slots each being in the same plane as the respective receiving holes 24. Receiving slots 40 receive connecting web 30 of the inserted insertion comb 26. In this condition, firstly, the portions of phase barriers 38 adjacent to receiving slots 40 embrace connecting web 30 on both sides and secondly, at right angles thereto, the portions of connecting web 30 adjacent to compensating slots 36 embrace phase barriers 38 on both sides. In this manner, cross-shaped connections are formed by insertion combs 26 and switching device housing 4.

[0021] Due to the partly frictional and partly form-locking connection of contact straps 8 in switching device housing 4, which is provided, on the one hand, by the cooperating elements central portion 18 and guide elements 16 and, on the other hand, by the cooperating elements receiving holes 24, insertion pins 28 and through-holes 22, a simple, reliable, and easily removable securing arrangement is implemented. Insertion pins 28 are subjected to shear stress, especially when tensile loads are applied to the terminals. The cross-sectional area of insertion pins 28, in conjunction with the material to be selected, has to be such that it withstands the expected loads. Due to the geometric design shown, insertion comb 26 is largely unaffected by tolerances. Phase spacing differences of switching device housing 4 in the millimeter range can

be coped with by insertion comb 26 without difficulty. In order that the attention of the customer doing the removal and mounting work is attracted to insertion combs 26, it is recommended for these parts to have a color distinctly different from switching device housing 4.

[0022] The present invention is not limited to the specific embodiments described above but includes also all equally acting embodiments along the lines of the present invention. Thus, for example, the present invention can be developed such that the insertion pins have single or crisscross slits along their longitudinal axis in order to produce an elastic clamping force.